LEARNING ACTIVITY:

Liquefaction

Grade Level: 5-10

Materials

- 4 quarts of topsoil
- 4 quarts of sand
- 4 quarts of dry peat
- 3 liters of water
- 1 liter measuring cup or graduated cylinder
- 3 plastic shoebox-sized containers (about 6 quarts)
- A large container in which the three smaller containers can slide around
- Enough Legos™ or other building blocks to make an 8cm x 10cm house
- Metric ruler
- Pen

Soil Science Society of America

Source: Soil Science Society of America. Adapted with permission.

When it comes to slipping, sliding, and stability in soils, the key word is "liquefaction."

During an event like an earthquake, liquefaction is the process by which saturated soil behaves like a liquid. This can be problematic, as a liquid soil loses structure and can cause buildings to sink, foundations to crack, and soil to slide down slopes all at once.

How does the type of soil affect how much a house will sink or shift during an earthquake? Conduct an experiment to test your ideas!

Procedure

1. Hypothesize which soil type—peat, sand, or topsoil—will be most resistant to liquefaction.
2. Fill each of small plastic container about 2/3 full—one with sand, one with topsoil, one with peat.
3. Use the Legos™ to build a "house" about 8cm x 10cm.
4. Add 1 liter of water to the topsoil. Place the model house on top of the soil. Place the soil container in the middle of the larger container.
5. Use the ruler to measure the house's height—from the soil surface to the top of the house—and then place the containers on a flat surface.* With a partner, roughly shake the outside container for 40 seconds. Do not lift the containers off the surface.
6. While shaking, observe the soil.
7. Re-measure the house's height. Record in the table here.
8. Remove the house from the topsoil.
9. Even out the soil surface and repeat steps 4-6 twice.
10. Repeat steps 3-7 with sand, then with peat. Each soil medium gets three repetitions.

DEPTH OF HOUSE SINK (CM) BY SOIL TYPE			
	PEAT	*SAND*	*TOPSOIL*
Trial 1			
Trial 2			
Trial 3			
Mean Measurement			
Notes On House Shift (Front, Back, Side, Etc.)			

Questions

- How did the soil behave when shaken? When still?
- What patterns did you observe?
- Which soil provided best stability? Why?
- Based on this experiment, what do you think happens to buildings in earthquakes? Can you find photos on the Internet to confirm your hypothesis?

Further Exploration

- Try the experiment with "houses" of different weights.
- Try it with different amounts of water.
- Come up with your own variable to test.

SSSA thanks sixth-grader Joshua Miller, who shared this experiment with us from his 2015 entry in the Colorado State Science Fair.

** Take care to protect the surface of the bench, desk, or whatever surface you use. Some sand grains may fall between the shaken container and the surface and may cause scratches.*

NGSS 3-D Learning

- Science and Engineering Practices—Developing and Using Models
- Disciplinary Core Ideas—Earth and Human Activity
- Crosscutting Concepts—Stability and Change